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A process model leading to successful implementation of electronic health record systems

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Abstract: The implementation of electronic health record (EHR) systems presents a number of difficult challenges for practitioners. Until now, no study in the Information Systems discipline has rigorously examined these challenges. This paper proposes a process model of the factors leading to successful implementation of EHR systems. The process is composed of three stages: pre-implementation, implementation, and post-implementation. Each stage involves specific factors which are based on the system development life cycle theory, the general systems theory, and the contingency model. These theories are also used to validate the model. A quantitative tool based on the maximised expected payoffs is used to assess the model and demonstrate its usefulness for best practices. The implications for both researchers and practitioners are discussed.

Keywords: EHR implementation; critical success factors; healthcare information systems; electronic health record systems; process model; meaningful use; monitoring.

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Biographical notes: Mohammad I. Merhi is an Assistant Professor at the Judd Leighton School of Business & Economics at Indiana University South Bend. His research interests include behavioural aspects of information security and privacy, effects of culture on information systems, and adoption and implementation of information systems including health information technologies, e-government systems, and e-commerce. He has published his research in several leading reputable journals. He has also presented his research at leading international and national conference meetings and workshops. He is a reviewer for several reputable journals and conferences.

1 Introduction

The diffusion and implementation of electronic health record (EHR) systems continue to generate a lot of interest among researchers and practitioners. An EHR system is defined as “a repository of patient data in digital form; stored and exchanged securely,

and accessible by multiple authorised users. It contains retrospective, concurrent, and prospective information and its primary purpose is to support continuing, efficient and quality integrated healthcare” (Häyrinen et al., 2008, p.293). EHR systems have the potential to lower costs, increase legibility, minimise errors, and improve the general efficiency and effectiveness of healthcare services (Blumenthal and Glaser, 2007; Chaudhry et al., 2006; Mitchell and Yaylacicegi, 2012; Tiwari and Kumar, 2015). Despite promising great benefits, the implementation of EHR systems remains challenging (Nguyen et al., 2014; Raghavan et al., 2015; Teufel et al., 2015; Zandieh et al., 2008). In the information systems (IS) literature, many studies have identified the myriad challenges impacting the implementation of EHR systems (Gans et al., 2005; Ludwick and Doucette, 2009; Ludwick et al., 2010; Rantz et al., 2010; Sheikh et al., 2011), but, until now, no study in the IS discipline has rigorously examined these challenges. This paper aims to bridge this gap in the IS literature by proposing a process model that demonstrates how to avoid the challenges and successfully implement EHR systems.

EHR systems can be considered to be at the heart of information in any medical practice/institution and are intended to replace the paper-based medical record file form or to complement the current IS (Purnama and Hartati, 2012). During the transition of implementation, however, practices rarely remain static. They run into problems, which they try to solve in the right way, but, most of them loose control over the unwieldy and mutable project. One of the reasons for failure in EHR implementation is usually because management has not taken the time to fully assess its needs. Successful implementation is only achievable when high-level executives assess the current state of their practice and the available technological, human or other resources that they have. A second reason is not implementing a standard shift in the way things are done before EHR implementation (McCarthy and Eastman, 2013). Because EHR requires changes to an organisation’s daily operations, it is very critical to re-structure the institution in a way that will be compatible with the new system in order to fully take advantage of it. Another reason institutions often fail in this process is because of the complicated integration of institutional and technical aspects (Pratt et al., 2004). Most practices that implement EHR are unlikely to have technical processes and structures compatible with the types of information provided by the new EHR systems (Pratt et al., 2004). Finally, having all the information about their patients in one database increases the risk of data breaches in case any IS security incidents do happen.

In general the EHR implementation requires synchronisation across all different functional areas in the institution, as well as external entities such as clinics, laboratories, and/or hospitals (Piliouras et al., 2011; Van de Velde, 2000). The fact that many entities are involved in the project makes the process even more complicated. For this reason, EHR system implementation should be considered a careful exercise that requires strategic thinking, precision planning, and negotiations among departments and divisions, with leadership that will direct the project and resolve any complexities that may arise. To implement an EHR system smoothly and successfully, institutions require a steering committee to lead and participate in team meetings, spend time with people, monitor the implementation efforts, and to provide clear direction of the project by giving feedback throughout the implementation process (McCarthy and Eastman, 2013). Monitoring and feedback include the exchange of information between all project team members from multiple areas, including users (Middleton et al., 2013). Project leaders may need to make

adjustments to institutional systems and processes as necessary in order to shape and successfully implement EHR (Lorenzi et al., 2009).

2 Statement of the problem

The implementation of EHR Systems is widespread and has been well recognised as complicated, expensive, and time-consuming. Implementation duration depends on the size of the institution; it might take a few months for small institutions/clinics, whereas it might take years for large ones. According to a report by Accenture, it was expected, despite slower-than-predicted growth, that the global market of EHR systems would reach \$22.3 billion by the end of 2015 (Accenture, 2014). The huge amount of resources invested by practitioners is expected to achieve success, to increase the quality of healthcare services, and to lower costs. Unfortunately, analyst reports still point out that the return on EHR investments is very low or negative in many cases because these projects often fail to improve service quality (McCann, 2013). For instance, after surveying 17,000 active EHR adopters, it was found that 54% of the respondents reported that their system failed to meet their needs (McCann, 2013).

During implementation, practitioners are also facing a number of challenges. According to Heisey-Grove et al. (2014, p.146), “in 2012, there were 19,209 challenges and on track issues entered in the Office of the National Coordinator for Health Information Technology’s CRM. Twenty-two percent of sites have multiple issues reported. Thirty percent of all participating regional extension centres providers ($n = 143,012$) have either an on track or challenge issue reported”. These statistics and numbers call for studies that examine the factors which can help avoid the challenges faced during EHR implementation.

3 Statement of the objective

Practitioners are looking for ways to achieve success in EHR implementation, especially after investing enormous amounts of resources in this project (Accenture, 2014). On the basis of the previous literature on EHR and enterprise resource planning (ERP) implementation, this study presents a model with four primary aims. The first aim is to identify and extract the significant factors impacting the implementation of EHR systems and then to present them in an integrated model. The second aim is to present a process model comprised of three major stages: pre-implementation, implementation, and post-implementation. The third objective is to validate the presented model using well-established theories such as the system development life cycle theory, the general systems theory, and the contingency model. The final objective is to present an example that demonstrates how the model can be measured and applied in practice.

The presented model is a holistic, flexible, and dynamic framework expected to help both researchers and practitioners. Practitioners will find in this study a powerful means for identifying fundamental factors that can lead to smooth implementation and success. This model is flexible in that it can be used in different sized organisations: large, medium, or small; and countries: emerging or developed. Different organisations have different resources and cultures; depending on its use, this model can function as an integrated tool with all the factors, or with just a few of them. For researchers,

the framework presented can be used as a foundation for assessing the contribution level of each factor, as well as the contribution level of each stage, to the success of EHR implementation.

4 Proposed model and taxonomy

The EHR Systems process model is based on previous literature in EHR and ERP implementation. The model has important characteristics, highlighted below:

- Firstly, this is a dynamic model. Different institutions have different managerial, human, and technological readiness levels. This model identifies multiple factors for each of these categories. The combination of all the factors together leads to successful EHR implementation.
- Secondly, it is an integrated model that includes factors extracted from different literature. Since EHR and ERP are similar systems in term of their objectives and structures, it can be assumed that these systems share common factors that affect their success and implementation.
- Finally, this is a process model. Many researchers have attempted to list, define, and label these factors as mentioned previously (Ludwick and Doucette, 2009; Ludwick et al., 2010; Rantz et al., 2010; Sheikh et al., 2011). The research framework introduced in this paper classifies factors of successful EHR implementation into three phases. The first is the pre-implementation, in which decision makers choose to go with the project or not. This is followed by the second stage – the implementation – which is made up of three subcategories: management, human resources, and technology. These categories are interrelated owing to the fact that EHR software implementation is a very complex process. A monitoring and feedback process should be done periodically throughout the whole stage of the project in order to achieve the expected final result. Finally, the successful implementation (goal of the project) will be achieved.

An illustration of the EHR Process Model is depicted in Figure 1.

4.1 Pre-implementation

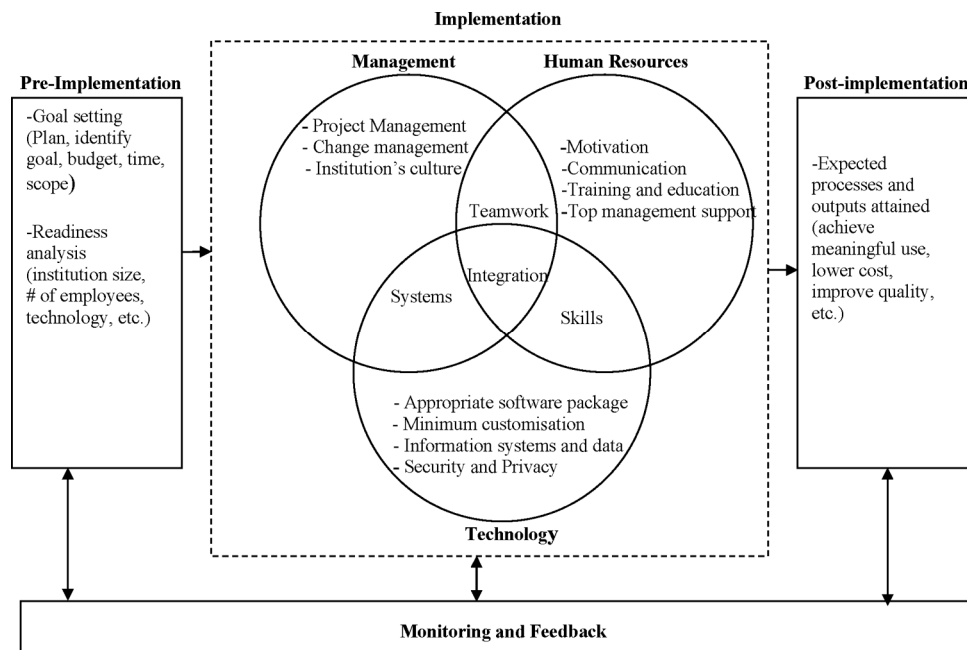
Pre-implementation is the first stage in the process of EHR systems implementation. This stage includes the preparation and the assessment of the current state of the institution. On the basis of the assessment, decision makers can decide on the route that should be taken for the implementation. The pre-implementation stage consists of two elements: goal setting and readiness assessment.

4.1.1 Goal setting

This is an important first part of any project. Every project should begin by defining the goals, the available resources, the timeline, and the possible methods needed to accomplish these goals. Goal setting has a dual benefit: it defines what the project aim is, as well as motivates the stakeholders to commit to the project. A well-defined goal helps stakeholders to work harder towards achieving it. Also, a clear business vision for the

project is required because, without it, implementation is likely to be lengthy, costly, and the result will not be the same as anticipated (Kaplan and Harris-Salamone, 2009). It is crucial to know up-front what the implementation costs will be in order to set aside the necessary funds (Neumeier et al., 2015). Also, having a realistic time frame for target completion is very important because, if the deadline schedules are unrealistically short or long, the pressure to rush or slow through would result in the implementation being carried out in an unorganised manner.

Figure 1 A process model of EHR implementation



4.1.2 Readiness analysis

The assessment of the current state of the institution, including the technological, monetary, and human resources, is very crucial and important and it has to be done before starting the implementation. Every institution has its own structure, different from other institutions. During the readiness analysis, decision makers should identify the size of the company, the type of work that is done in it, the number of employees, as well as their ability to adapt to new technology such as EHR systems. Managers and decision makers cannot simply look at what other institutions have done before and follow the same application. The readiness assessment should clearly provide decision makers an answer to the question on whether or not the institution is able to start the project at this time and what modifications need to be done before starting the project.

4.2 Implementation

This is the stage that follows the preparation and the assessment. At this stage, decision makers decided to start the project. The implementation stage consists of three categories: management, human resources, and technology. Each of these categories

involves specific factors that interact and lead to successful implementation. These factors are discussed below.

4.2.1 Management

4.2.1.1 Effective project management

Effective project management is necessary in almost every project. EHR implementation is not a special case and thus also requires excellent project management, which includes a clear definition of objectives, development of both a work plan and a resource plan, and careful tracking of the project progress (Kushniruk, 2008). The project scope is one of the important things that management should take care of because EHR systems implementation is very complex. A project scope should be clearly defined and should identify the modules selected for implementation. Choosing not to modify the software and to keep it as is can help minimise the project's complexity and keep the delivery on schedule.

4.2.1.2 Change management

Effective change management is important for the implementation of new technologies (Grover et al., 1995) and absolutely fundamental for EHR because these systems change an institution's day-to-day operations (McCarthy and Eastman, 2013). EHR systems introduce new processes and methods, causing changes in social and technical environments that can, without effective change management, lead to confusion and inefficiency. The changes caused by the implementation of EHR generate users' resistance because people generally prefer the status quo. Employees' resistance to change has been found to be a major factor in many project failures (Merhi and Ahluwalia, 2015). Because managing resistance is important, institutions need to focus on employees' beliefs and attitudes when implementing EHR systems.

4.2.1.3 Organisational culture

An institution's culture can be defined as the values, social ideals, and beliefs that its employees share (Yeung et al., 1991). Within an organisation, culture defines what is of importance within that particular organisation and influences, as well as directs, everyone in the organisation. Organisational culture will be affected by the implementation of EHR because these systems are accompanied by changes (Nowinski et al., 2007). Culture has been found to have a significant impact on the acceptance and use of information technologies and systems at the organisational level in both medical (Hu et al., 1999; Kaplan and Shaw, 2002) and non-medical areas (Harper and Utley, 2001). Even within the same organisation and at the departmental levels, culture has been found to have influence on the success of IS. For instance, Grote and Baitsch (1991) found that the use of an integrated computerised office communication system varied according to the pre-existing cultures within different departments. Thus, it is important to understand the organisational culture and to change it in an appropriate way that makes the implementation of EHR system smooth and successful.

4.2.2 Human resources

4.2.2.1 Motivation

Motivation represents the forces within individuals that influence their direction, intensity, and persistence of voluntary behaviour (Pinder, 1998). Direction is the path that individuals take to achieve goals. Intensity refers to the amount of effort that individuals put toward the goals, while persistence is the duration that individuals can sustain their efforts in order to achieve the desired goal. In a meta-analysis of 117 studies on the barrier and facilitator factors affecting EHR, McGinn et al. (2011) reported that motivation has been found to be both a barrier and a facilitator. In IS literature, motivation has also been found to be a critical factor that significantly influences the implementation, adoption, and usage of technologies (Hwang, 2005). Thus, by motivating the employees, institutions can achieve a successful implementation of EHR.

4.2.2.2 Communication

Communication is a means of coordination between all teams involved in the project and can be considered a key driver in knowledge management; it helps in distributing information among employees so that everyone remains knowledgeable about particular tasks and changes. Communication is the glue that holds the whole organisation, as well as the teams, together. It also increases the personnel's commitment to change, as well as reduces confusion and resistance to change (Lippitt, 1997). The lack of communication has been linked to many project failures. Effective communication leads to the development of the trust and exchange of information needed for successful process changes and the acceptance of the technology (Amoako-Gyampah and Salam, 2004). For this reason, organisations need to improve their communication during EHR implementation.

4.2.2.3 Training and education

Introducing new technology to employees should always be accompanied by training to teach them how to use the new system. Training should be provided and considered as part of the EHR implementation process because it affects the shared beliefs about the benefits of this system. It allows users to interact with the EHR and provides a means for them to develop skills that help them use the system later. The main goal of the training is to increase the expertise and knowledge level of the users at all levels of the institution. For this reason, adequate training can help increase the success of EHR systems. Markus et al. (2000) argue that the lack of user training and the failure to completely understand how the business processes change inside the organisation with the new technology could be an impediment to successful implementation. McAlearney et al. (2012) suggest that lack of proper training can demotivate EHR users, thus they propose an on-going training as a way to ensure success in implementing EHR.

4.2.2.4 Top management support

Young and Jordan (2008) define top management support as: "devoting time to the [IS] program in proportion to its cost and potential, reviewing plans, following up on results and facilitating the management problems involved with integrating technologies with the

management process of the business". Top management support is considered to be an important antecedent of the success of many high cost or strategic value IT projects such as ERP implementations and R&D projects (Green, 1995; Ke and Wei, 2008). McComb et al. (2008) propose that top management members should lend support by establishing themselves as project champions in order to show their high commitment and interest in the project. Top management should be involved in allocating the people and resources needed for continuous improvement after the completion of the main project. Thus, in order to make the EHR implementation a success, top management need to make continuous contributions and commitments.

4.2.3 Technology

4.2.3.1 Appropriate software package

Choosing the appropriate EHR software package that best matches the institution's information needs is vital in order to guarantee minimal customisation. Organisations are different and each has its own structure and business process. This means that a software package that fits one organisation may not fit another. In fact, not all EHR software packages are compatible with all companies. The institution assessment that is done in the pre-implementation stage should provide the data necessary for making the decision about what software package to adopt and use.

4.2.3.2 Minimum customisation

It is advised that business processes should be changed to fit the new system and not vice versa. The reason is because customisations are usually associated with an increase in the costs and implementation time, along with decreasing and limiting the ability of updates and upgrades of the software later on. Customisations should be avoided to reduce errors and to take advantage of newer versions and releases. To summarise, institutions that are willing to implement EHR systems should be prepared to change the business to fit the software with minimal customisation, instead of changing the software to fit the business.

4.2.3.3 Information and data

With the implementation of the new EHR systems, it becomes mandatory for most of the institutions to convert the data from the old systems to the new one. The process of converting the data between the systems is always considered a big challenge for organisations because different systems have different data type definitions. Ensuring that the data are accurate during the conversion process has wide-ranging effects and can ultimately lead to successful EHR implementation. Data accuracy and correct data should be top priorities in the conversion process. EHR systems are integrated systems that integrate multiple departments, which means a mistake in the process of data conversion can lead to a major problem. Training employees to ensure that they know how to correctly convert data will be beneficial since it shows them the result of mistakes that can occur at this stage. Besides, it is recommended to use the direct conversion method where all the old systems must be eliminated and employees have no choice but to use the new EHR systems.

4.2.3.4 Security and privacy

Security can be defined as the protection against incidents that cause harm to data or networks in the form of destruction, non-protection, modification, mismanagement, and/or abuse (Koong et al., 2013; Merhi and Koong, 2016). Data about patients need to be highly secured and protected by the hospitals and clinics in order to prevent misuse and fraud. Patients must feel confident that their private information will not be lost, sold, or otherwise misused. This means that the higher the level of EHR system security, the higher the level of patients' confidence and trust in using these systems (van der Linden et al., 2009).

Privacy policies allow patients to find out how their information may be used and what disclosures of their information have been made. It allows patients to find out how their information is going to be protected and to know that the people handling their information have been properly trained and the systems designed to protect their privacy. Generally, good privacy policies limit the release of information to the minimum number of avenues reasonably needed for the purposes of the disclosure (Merhi and Ahluwalia, 2013, 2014; Merhi and Midha, 2012).

4.3 Post implementation

This is the last stage of the implementation. During this stage, executives can identify whether they have achieved the expected and planned outputs or not. The main expected output is to reach the meaningful use of the EHR system by:

- improving the quality, safety, and efficiency of healthcare outcomes
- improving care coordination and public health outcomes
- maintaining the privacy and security of patients' information
- increasing transparency and efficiency of operations
- reducing costs for the institutions and patients
- and otherwise using the patients' data more efficiently and effectively (HealthIT.gov).

4.4 Monitoring and feedback

It is essential to ensure that the project and the whole process of EHR implementation remain on the right path, as planned in technical and organisational terms. Monitoring and Feedback are the link between all phases and factors of EHR implementation. Finding problems at an early stage, while working on the project, almost always makes fixing them easier than delaying and finding problems later. This is called corrective feedback because employees can catch the errors and fix them. Another benefit of the feedback is that it can be used as a motivational tool, especially when employees get positive feedback. This will help them to give more to the project in order to achieve the overall plan and goals.

In order to be effective, feedback should be:

- specific, which means it should not merely be a general description of the work done, but it should be more detailed, highlighting every minute particular
- periodic, which means it should be done frequently during the whole project in order to evaluate it, especially when new stages are added.

In the process of implementation, the management and the human resources should be linked and have in common teamwork, management and technology with system, human resources management and technology with skills; and all three categories should have the integration which is the main objective of the EHR system.

5 Model validation

The factors of the EHR implementation model are each validated across three major theories. These theories are namely: systems development life cycle (SDLC), General Systems Theory (GST) and contingency theory (CT). The SDLC is a traditional conceptual model used in project management, tailored toward the design and development of IS from the planning phase through the maintenance phase (O'Brien and Marakas, 2007; Valacich et al., 2015). In other words, this model explains the process of creating and designing IS. The SDLC is composed of five stages: initiating/defining, planning, executing, controlling, and closing. EHR is basically an IS which should be designed and implemented based on the SDLC.

The GST was proposed in the 1940s by the biologist Ludwig von Bertalanffy. It states that a system is an integration of some components held together through some common and cohesive bond. Von Bertalanffy (1976) noted that these components are open to, and interact with, their environments. The components can also acquire qualitatively new properties through emergence; thus, they are in a continual evolution. These components have a basic and important role in the system as a whole and they affect it; losing one of these components could lead to the failure of the system and sometimes to a systems death. Rather than reducing an entity to the properties of its components, GST focuses on the arrangement of and relationships between the components that are interconnected. Every system has a purpose that can be achieved from the contributions of the components that are in it. In addition, systems operate routinely and, as such, they are predictable in terms of how they work and what they will produce. Regardless of the type of system, all systems should have these previously mentioned properties. Implementation of an EHR system also falls into this category, since it is composed of multiple stages that all together lead to the success of the project.

The CT is a theory that has been widely used in management and leadership literature. CT starts with the theme of "it depends," arguing that the solution to any one managerial problem is contingent on the factors that are impinging on the situation (Drazin and Van de Ven, 1985). According to CT, there is no ideal method of making decisions, organising, and/or leading a corporation. It declares that when managers

make a decision, they must take into account all aspects of the current situation and act accordingly. In the case of EHR, it can be argued that its effectiveness is contingent on certain factors affecting its implementation.

Table 1 illustrates how the variables of the model are interrelated to these theories. The 'X' symbol indicates that the particular factor has been linked to the theory. As indicated in Table 1, one can see that each of the factors can be explained by one or more approaches. For example, it can be seen that all the factors of the model are parts of the SDLC and that is true due to the fact that the EHR systems are integrated systems that follow the stages of SDLC, too.

Table 1 Linking the factors of the model to three theories

<i>Critical success factors</i>	<i>System development life cycle theory</i>	<i>General systems theory</i>	<i>Contingency theory</i>
<i>Stage 1: Pre-implementation</i>			
Goal setting	X	X	X
Readiness analysis	X	X	X
<i>Stage 2: Implementation</i>			
Project management	X	X	X
Change management	X	X	X
Company's culture	X	X	X
Motivation	X	X	X
Communication	X	X	X
Training and education	X	X	X
Top management support	X	X	X
Software package	X	X	X
Minimum customisation	X	X	X
Information and data network	X	X	X
Security and privacy	X	X	
<i>Stage 3: Monitoring and feedback</i>			
Monitoring and feedback	X	X	X
<i>Stage 4: Post-Implementation</i>			
Meaningful use	X	X	X

The EHR implementation model is formed from many stages to create the holistic system, which means that it is built based on the GST. From Table 1, it can also be seen that the factors of the proposed model can be linked to the GST. In addition, it is obvious that goal setting, readiness analysis, project management, change management, motivation, communication, monitoring & feedback and meaningful use are parts of the CT which are included in the model. Thus, because the variables of the EHR model are associated with these well-established theories, it can be concluded that the proposed framework does have high theoretical construct validity.

6 Model assessment

The maximising expected payoffs was used in order to assess the proposed model. This method is usually used when decision makers are not certain of events or outcomes. It helps them to make decisions based on the calculated expected payoffs. To apply this method and calculate the expected payoffs, the events are first identified as well as the decisions. Next, probabilities are assigned to these events and experts assign estimated payoffs to the decisions. Then, the expected payoffs will be calculated by multiplying the payoffs by the probabilities. Finally, the expected payoffs are calculated by adding the calculated values that lead decision makers to choose the maximum payoff.

For practical purposes, this technique is applied to the model presented in this study in Table 2. First of all, three events are identified for the implementation of the EHR systems: optimal, moderate, and low with three probabilities 0.1, 0.6, and 0.3 that are assigned respectively. Next, the decisions are taken from the implementation part of the proposed model since it is the process phase of the model. The decisions are: Management, Human Resources, and Software, where each of these decisions has many sub-decisions. Different payoffs for the sub-decisions are then estimated. Next, the expected payoff for each sub-decision, given each decision, is calculated, and finally the total expected payoff for each decision is calculated.

On the basis of the results shown on Table 2, the Human Resources has the highest expected payoff. Thus, Human Resources should be considered of highest importance for institutions wanting to successfully implement EHR systems. It should be noted here that the result given in this table is logical owing to the importance of the human resources in this kind of project. Having the right software, minimum customisation, and change management do not have the same impact on the success of the project as the motivation, employee involvement, communication, training, and top management support do.

7 Conclusions, implications, and directions for future studies

This study provides a practical taxonomy model that demonstrates the process for successful implementation of EHR systems. The model is composed of three stages: pre-implementation, implementation, and post-implementation. The implementation stage consists of three sub-categories: management, human resources, and technology. Each of these categories includes multiple factors that altogether lead to successful EHR implementation.

Specifically, the model presented is a systematic framework incorporating multiple factors which influence EHR systems implementation. Practically speaking, EHR systems implementation depends on variables associated with SDLC, GST, and contingency theory. Simply put, these common theories mean that to be implemented successfully, all systems have to hold a systematic nature, and need to be flexible.

An important factor of the model presented is monitoring which starts on day one and continues until after implementation. EHR implementation is challenging and requires time, effort, and resources. Thus, it is very critical that decision makers at the institutional and federal levels stay focused on achieving success and adoption throughout the institutions.

Table 2 Maximisation of expected payoff

		Decision																						
		Management						Human resources						Technology										
		PM		CM		CC		Mot		Com		T&E		TMS		SP		Cust		I&D		S&P		
Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr	P	P.Pr
Event																								
Optimal	0.1	20	2	20	2	15	1.5	10	1	15	1.5	10	1	25	2.5	7	0.7	6	0.6	10	1	20	2	
Moderate	0.6	10	6	9	5.4	8	4.8	8	4.8	13	7.8	5	3	12	7.2	4	2.4	4	2.4	8	4.8	15	9	
Low	0.3	3	0.9	4.5	1.3	2	0.6	6	1.8	7	2.1	2	0.6	9	2.7	2	0.6	1	0.3	5	1.5	10	3	
Expected payoff			8.9		8.7		6.9		7.6		11.4		4.6	12.4	3.7	3.3		7.3		28.3		14		
				24.5								36												

The numbers are in 100s.

Pr: Probability.

P: Payoff.

PM: Project management.

CM: Change management.

CC: Company's culture.

Mot: Motivation.

Com: Communication.

T&E: Training and education.

TMS: Top management support.

SP: Software package.

Cust: Customisation.

I&D: Information and data.

S&P: Security and privacy.

During implementation, monitoring comes from decision makers in the institutions as well as federal (e.g., state). Decision makers in the institutions have adequate knowledge about the internal situation of the organisation whereas decision makers at the federal level have more experience because they interact with many institutions. Adding the experience of both internal and external parties may lead to success.

After implementation, institutions need to track whether and how users use the new system. Surveying users about their experiences with the new EHR systems identifies issues that users are facing and/or glitches in the implementation. Training helps users to solve the technical issues they are facing with the new system. Monitoring also helps both the institution and the government to identify whether an institution has met the requirement and is in the track attainment of meaningful use.

It should be emphasised here that the model was validated using sound and established theories. The theories include SDLC, GST, and contingency theory. Each of the classical theories used is commonly accepted as the basis for technology adoption as well as the technology implementation and effectiveness.

Furthermore, an assessment methodology, which is simple and yet comprehensive, was used in this study in order to demonstrate how the framework can be measured. By using experts' and users' opinions, decision makers may find this method valuable. It should be noted that this method is a commonly used IS assessment tool in analysis and design, project management, and operation management. Thus, this model is practical and easy to assess.

Like all models presented and assessed, users must take into consideration the resources and conditions available, since they may change over time or may vary based on other demographic factors. For instance, institutions have different sizes, cultures, as well as resource capabilities. The good news is this that is a generic model that is dynamic and adaptive so it can be tailored to new factors to better fit the users. Obviously, additional research and modifications, as well as updating of the model, by adding other factors specific to users' needs, will definitely enrich the body of knowledge about EHR implementation.

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